

This is a repository copy of *World prehistory from the margins: the role of coastlines in human evolution*.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/1897/>

Article:

Bailey, G. orcid.org/0000-0003-2656-830X (2004) World prehistory from the margins: the role of coastlines in human evolution. *Journal of Interdisciplinary Studies in History and Archaeology*. pp. 39-50. ISSN 0973-0125

Reuse

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

World Prehistory from the Margins: The Role of Coastlines in Human Evolution

Geoff Bailey

Professor of Archaeology, University of New Castle, U.K.

ABSTRACT

Conventional accounts of world prehistory are dominated by land-based narratives progressing from scavenging and hunting of land mammals and gathering of plants to animal domestication and crop agriculture, and ultimately to urban civilisations supported by agricultural surpluses and trade. The use of coastlines and marine resources has been viewed as marginal, late in the sequence, or anomalous. This bias is primarily the result of three factors: the removal of most relevant evidence by sea-level change; the bad press given to coastal hunters and gatherers by 19th century ethnographers; and a belief in technological 'primitivism'. In this paper I will examine the case for treating coastal habitats as amongst the most attractive for human settlement, and coastlines and seaways not as barriers but as gateways to human movement and contact, from early hominid dispersals to the rise of the great coastal and riverine civilisations.

Introduction

The recent claims of a submerged Harappan city 40m beneath the surface of sea in the Gulf of Khambhat in Northwest India have re-emphasised the impact of sea-level change on the archaeological record, and the potential importance of the now-submerged landscapes and coastlines of the continental shelf. Just what the Khambhat finds consist of, and just how much of the material dredged up from the sea bed represents genuine artefacts, let alone evidence of a submerged Harappan city at least 2,000 years older than its counterparts on dry land, will have to await detailed and expert scrutiny. Nevertheless, this discovery has attracted worldwide media attention (e.g. Lister and Teeman 2002), and suggests a widespread and unfulfilled public appetite for tales of lost civilisations and sunken continents. The notion that archaeological sites might have been preserved on land surfaces drowned by the late glacial sea-level rise is not new (e.g. Flemming 1998, Masters and Flemming 1983). Nor is the idea that coastlines and marine resources might have played a much more important role in the earlier stages of human development than is usually allowed for in conventional syntheses of world prehistory (e.g. Sauer 1962). However, it has usually been left to biologists, geographers, oceanographers, journalists and amateur enthusiasts to advocate such views (Hardy 1960; Flemming 1998; Hancock 2002; Morgan 1982; Oppenheimer 1998; Sauer 1962) and professional archaeologists have remained sceptical. In this paper I shall briefly examine some of the reasons for this scepticism, and outline evidence that suggests we should now take more seriously the investigation of coastlines, both above and below present sea level.

Loss of evidence

Three principal reasons can be identified for the longstanding scepticism of professional archaeologists. The first is the widespread belief that evidence for human occupation of now drowned landscapes and coastlines is unlikely to have survived inundation. Or, if archaeological evidence has survived, it is likely to be so difficult to locate and recover that it would be as difficult as looking for a needle in a haystack, perhaps worse, because, so the argument goes, we do not even know with any confidence where the haystacks are. The destruction of material by the pounding of surf as the rising waters engulfed ancient settlements, the displacement or burial of material by submarine erosion or accumulation of sediments, or the loss of stratigraphic integrity and removal of contextual information, can all be cited as powerful reasons for doing nothing. On this argument, the dredging up of isolated artefacts, like the famous Mesolithic harpoons brought up from the bed of the North Sea by trawler fishermen early in the last century (Coles 1998), are at best enigmatic hints of an inaccessible world that can never be recovered.

This extreme view is becoming harder to maintain in the face of the steady accumulation of finds that has been reported over the past 30 years. Not only isolated artefacts but whole settlements have been recovered, and in some cases excavated, ranging in age from Middle Palaeolithic campsites to Roman harbours (Flemming 1998). Many of these began as chance finds recovered by divers or dredging and drilling operations on the sea floor, which were later followed up by more systematic archaeological investigation. The recent discovery of a Lower Palaeolithic handaxe off the coast of South Africa demonstrates that artefact material can survive more than one cycle of sea-level change (Werz and Flemming 2001)). An expanding array of ever more powerful techniques for remote sensing and underwater survey, and the accumulation of sediment cores from offshore gas and oil exploration, hold out the prospect of more detailed reconstructions of submarine topography. Underwater identification of surviving land surfaces, and locations favourable for siting of ancient settlements and for the recovery of their material remains, are increasingly within our technical grasp (Fischer 1995; Johnson and Stright 1992). As for the risks of erosion and burial by submarine sediment movements, these are no worse than for archaeological material on land, where such risks are compounded by the much greater disturbance and destruction of agricultural and industrial activity, and the increasing demands and environmental impacts of modern society.

'So what?' the sceptical archaeologist might cry. 'The evidence may be there, and it may be possible to recover it with great expenditure of effort and money and the deployment of impressive and sophisticated technology. But will it tell us anything about past societies and the pattern of human development that we cannot learn from the study of more accessible material on land?' This is a reasonable question, especially for the less easily identifiable and technically more challenging prehistoric material at deeper levels beneath the sea. The excavation of submerged Mesolithic coastal sites in the Baltic (Andersen 1996) or of Pre-Pottery Neolithic villages in the eastern Mediterranean (Galili et al. 1988), arguably does not tell us anything new about the Scandinavian Mesolithic or early agriculture in the Levant. Indeed, apart from spectacular preservation of organic materials in some cases, the same point could be made about all the well-authenticated examples of underwater prehistory so far recovered. Until a case for its study is more

fully articulated, the sceptic is entitled to suppose that underwater prehistoric archaeology cannot tell us much more than we already know, with the added disadvantage that it will cost a great deal more of the taxpayer's money.

Ethnographic preconceptions

Another powerful source of inertia is the traditional image attributed to coastal hunter-gatherers by 19th century travellers and ethnographers. Ethnographic preconceptions have never fully recovered from Charles Darwin's eloquent and dramatic descriptions of Tierra del Fuego during his round-the-world voyage on the *Beagle* (Darwin 1839). Everything about the surviving Indian tribes of this coastline, their appearance, their material culture, their climate, and the very environment in which they lived, confined, so it seemed, to the stones on the beach and forced to wander from spot to spot in search of food, struck Darwin as 'wretched'. Darwin was scarcely able to imagine them as fellow-members of the human race, a judgement hardly disputed by 19th century ethnologists like Lewis Henry Morgan, who consigned the Indians of the Northwest coast of North America to the lowest level of savagery (Morgan 1877). These 19th century ethnographic analogies were imported into European prehistory by Sir John Lubbock, who compared the Mesolithic inhabitants of the Danish kitchen middens with the inhabitants of Tierra del Fuego (Lubbock 1895). The idea that Mesolithic coast dwellers had a 'low level of culture' persisted in the mid-20th century writings of Grahame Clark, Mortimer Wheeler and others (Clark 1952, Evans 1969, Wheeler 1954). Only later did a re-interpretation of the Northwest Coast Indians of North America supplant Tierra del Fuego as the ethnographic role model for archaeological interpretation. The prehistoric midden dwellers of Scandinavia have been rehabilitated as complex hunters and gatherers, practising a wide-ranging subsistence on sea and land, with food storage, sedentary settlements, high population densities, burial of their dead in cemeteries and all the hallmarks of 'social complexity' more commonly associated with farming societies (Renouf 1988, Rowley-Conwy 1983).

Even so it remains the case that many of the world's coastlines that have the most productive environmental conditions for heavy dependence on marine and intertidal resources, such as shallow continental shelves and upwelling currents, are in parts of the world that were only colonised by human populations relatively recently. The high latitude coastlines of North America and northern Europe and Asia, the eastern seaboard of North America, southern South America, and New Guinea and Australia all have some of the richest marine conditions for fisheries, sea mammals and shellfish in the world (Perlman 1980). Yet most of these areas not only have relatively recent prehistories of human colonisation, many also resisted the introduction of agriculture and urbanisation until the expansion of European people and technology in the past three centuries. Thus many areas of the world with some of the richest ethnographic and archaeological evidence of marine-based hunter-gatherer coastal societies seem to have remained essentially peripheral to the main currents of world prehistory and cultural evolution until a very recent period. Thus it is hard to resist the notion that hunter-gatherer coastal societies were not only marginal in the literal sense that they occupied the margins of the continental landmasses, but marginal in terms of global geography and cultural development.

Technological primitivism

A final reason for doubting the importance of marine resources and submerged coastlines in human development is the belief that the technology required for their exploitation did not appear until very late in the prehistoric record. Boats, fishhooks and harpoons are not represented by material remains in the archaeological record until the Postglacial period. All would have played an important role in extending the range and reliability of fishing and sea mammal hunting. Boats would have been of critical importance in extending the range of activities, encouraging exploration, and facilitating transportation, social contacts and exchange of resources across water barriers. Their absence from the Palaeolithic record thus encourages the belief that our Palaeolithic ancestors lacked the knowledge, skill and technology to exploit marine resources or make sea crossings.

Technological factors have obviously played an important role in securing food from the sea. But many simple technological aids could have been used without leaving unambiguous evidence of their function. Hand-held nets and spears, and simple bone gorges on the end of a line would give access to inshore fish, aided in suitable circumstances by simple brushwood dams or stone enclosures for trapping fish in shallow water. All of these features are within reach of a simple stone-age technology. The antiquity of individual items, particularly those made from perishable or rarely preserved materials such as nets and boats, can only be guessed at, or, in the case of boats, inferred indirectly from evidence of sea crossings. Archaeological evidence for the colonisation of Australia now demonstrates that planned sea journeys over distances of up to 100km were taking place at least 50,000 years ago, and has effectively undermined the preconception that seaworthy craft and navigational skills were restricted to the Postglacial period (Lourandos 1998). Moreover, many marine resources would appear to pose no technological constraints on exploitation at all – most intertidal molluscs, fish trapped by tidal movements in natural rock pools, and naturally stranded sea birds and sea mammals. The belief that maritime cultural activities were necessarily absent from the earlier periods of prehistory is thus unfounded. As so often in archaeological studies, absence of evidence is easily turned on its head and used as evidence of absence, thereby sustaining the specious argument that there is no need to undertake any counter-investigation because we already know the answer in advance! As we shall see below, the relevant evidence, if it exists, needs to be sought beneath the sea or in geologically unusual circumstances on dry land.

Sea-level change

Improved measurement of Pleistocene sea level change through calculation of ice volumes, stable isotope analysis of deep-sea cores, and dating of submerged peats and uplifted terrace sequences, has produced a detailed pattern of eustatic sea level change for the last glacial-interglacial cycle, and indeed beyond (Chappell and Shackleton 1986; Van Andel 1989). It is now widely accepted that at the maximum of the last glacial about 18,000 years ago, sea level was about 120m below the present, and that the late glacial sea-level rise associated with melting of the continental ice sheets reached the modern level about 5,000 to 6,000 years ago.

This has two very important consequences for archaeological interpretation. First, although this maximum lowering was relatively short-lived, persisting for perhaps 5,000

years, for most of the glacial period sea level was at least 50–60m below present. In fact extremes of sea-level variation, whether very high or very low, are relatively short-lived episodes on a Pleistocene time scale. The –60m level is closer to the norm, but still means that most of human existence before 6,000 years ago has been played out in a world of sea levels much lower than the present. Isostatic and rheostatic modelling of crustal deformation under varying loads of ice and water suggests regional and local variation in this pattern, especially close to the margin of the continental ice sheets (Lambeck 1995). But the implication is clear. More or less extensive tracts of the continental shelf would have been exposed as dry land, much of it attractive for human settlement.

Just how large an area would have been made available by lowered sea level is debatable. Even if we take the extreme of –120m as our reference point, rather than the –60m norm, we should remember that many of the most extensive areas of the continental shelf are at high latitudes: the Bering and Barents Seas of northern Asia and the North Sea of North West Europe. Some of these are arctic regions that are barely usable today, and none would have been habitable during glacial conditions. Or they are in the South Atlantic off the coast of Brazil and Argentina, an area generally considered marginal to human habitation until the very end of the last glacial period. The continental margins close to the main Old World centres of human evolution and early civilisation for the most part have narrower shelves. The major exceptions are the extensive shelf that skirts mainland China and the peninsulas and archipelagos of South East Asia, and more localised pockets around the Arabian Peninsula, parts of the Indian coastline and northern Australia. A conservative estimate of the extra area exposed as dry land that could be used for human occupation is about 16 million km², or some 10% of the current habitable area of the world. Even so this is a significant increment of new territory, especially if we remember that much of this coastal strip would have represented relatively attractive and well-watered land during the conditions of greater aridity that prevailed during glacial periods.

Secondly, most shorelines dating from before 6,000 years are by definition now submerged and some distance out from the present shoreline. Even on coastlines with steeply shelving submarine topography and a narrow continental shelf, last glacial shorelines would have been 5 to 10km distant from the present ones, taking the optimum location for shell middens and fishing camps well out beyond the present shore. One has to go back to 125,000 years to reach the previous period of high sea level equivalent to the present day. It follows that most of the locations that might provide evidence of maritime cultural activity and intensive marine-based palaeoeconomies are now lost to view, and that any surviving evidence lies submerged on the seabed.

The extreme rarity of coastal evidence before the closing stages of the late glacial, and the explosion of prehistoric coastal sites and shell middens after 6,000 years, has often been accepted as a historical fact. Impressive theoretical arguments invoking social, environmental and demographic variables have been woven around this apparently late development (Binford 1968; Cohen 1977; Osborn 1977; Yesner 1987). From a palaeogeographical perspective, however, it seems more plausible to suggest that the surviving coastal record is simply the most recent temporal fragment of a much longer history, just as the Pleistocene archaeological record is a geographical fragment of a more extensive and partly submerged settlement pattern. Moreover, it is clear that submarine evidence can be preserved and examined in a systematic manner. Flemming (Werz and Flemming 2001) has recently noted that some 300 submarine archaeological sites are now

known off the coasts of Europe, North America, Australia and Japan, with dates ranging from 5,000 to >45,000 years ago, and at depths of up to 145m and offshore distances of up to 50km.

Coastal histories

Opinions differ over whether the sea shore was a natural niche for early human populations (Erlandson 2001; Meehan 1977) or an unattractive one shunned until rising population levels and competition for resources on land forced a change in the Late Glacial and Postglacial periods (Cohen 1977; Osborn 1977). It is, however, difficult to ignore the attractions of life at the interface between land and sea, even at the simplest levels of technology. Coastlines typically offer numerous attractions: a wide range of plant and animal resources including easily collectable molluscs in the intertidal zone; more equable climatic conditions and higher water tables favourable to plant and animal life on land; more abundant water supplies; and a number of 'unearned' bounties washed up along the shore such as migratory birds or young seals beached by storms, stranded whales, and cobbles for stone implements. Moreover, the economic potential of marine resources in terms of food produced per unit area, even with simple equipment, compares favourably with the productivity of plants and animals on land, and in the most favourable circumstances with intensive crop cultivation. The extensive ethnographic records of hunters and gatherers in the Americas and Australia show a consistent trend towards higher population densities, smaller group territories and more sedentary settlements in coastal areas (Birdsell 1953; Kroeber 1939).

Coastlines also offer easy pathways of movement along the shore edge, and between coast and hinterland along river valleys, facilitating population migrations, cultural contacts, and relationships of trade and exchange. Complementarity of resources between different parts of the coastline, coast and interior, and coast and offshore islands, further enhances the possibility of social and cultural links and the dispersal and diffusion of people and ideas. There is no *a priori* reason why these advantages should not have been realised from the very earliest periods of prehistory. Water transport, even if it made a relatively late appearance in the prehistoric record, would have further extended and accelerated an already existing tendency.

The aquatic ape hypothesis first advanced by Sir Alister Hardy (1960) and later popularised and extended by Elaine Morgan (1982) remains controversial, not least because of lack of relevant archaeological or palaeontological evidence. Nevertheless Sauer (1962), inspired by this hypothesis, first speculated about the attraction of coastal environments for terrestrial hominids, and drew attention to the concentration of Lower Palaeolithic implements on raised coastal and river terraces, and the possibilities of intercontinental migration across narrow sea barriers between continental margins. These ideas have been reinforced by more recent surveys of evidence (Erlandson 2001).

Increasing attention is now being paid to the Palaeolithic record on either side of narrow sea crossings, for example the Straits of Gibraltar (Stringer et al. 2000), and the Bab el Mandeb crossing at the southern end of the Red Sea (Stringer 2000; Walters et al. 2000). It has often been assumed that hominid migrations out of Africa would have been constrained by a bottleneck comprising the Sinai Peninsula. The possibility of multiple or variable corridors for population movement into or out of Africa from Europe and Asia, making use of narrow sea crossings, would have far-reaching implications for models of human evolution and dispersal. The Arabian Peninsula has a pivotal geographical

position as a major bridge between Africa, the Fertile Crescent and Asia. If we assume a modest ability to cross narrow barriers of water, an obvious pathway for human movements between Africa and the Indian Subcontinent would have been via the Arabian Peninsula and the Makran coastline, rather than through the Levant and Mesopotamia. Numerous Palaeolithic finds on elevated marine terraces on the Arabian side of the Red Sea (Zarins et al. 1981) open up the prospect of further exploring these ideas through new field investigations.

Food remains of marine molluscs have been recovered in association with early cultural material and fossil remains of anatomically modern humans in the deep sequences of some South African caves, notably at Blombos and Klasies River Mouth (Deacon and Shuurman 1992; Henshilwood et al. 2001). These finds are dated to periods associated with the high sea level of the Last Interglacial about 125,000 years ago, or to the relatively high sea levels of about 80,000 years ago at the beginning of the Last Glacial period, when the contemporaneous coastline would have been quite close. At the Red Sea site of Abdur in Eritrea, lithic material and marine molluscs on an elevated marine terrace have also been dated to the Last Interglacial period. In combination with the South African evidence, this has led to the suggestion that intensification of shell gathering was a distinctive feature of anatomically modern humans, which helped to power a coast-wise dispersal out of Africa (Walters et al. 2000; Stringer 2000). Hypotheses of coastal colonisation have also been proposed for the earliest human entry into Australia and the Americas (Bowdler 1977; Erlandson 2001), in both cases believed to have taken place some time during the Last Glacial period. However, if these hypotheses are to be properly tested, we will need to know much more about the nature of coastal settlement and palaeoeconomy in the long intervening period of low sea level between about 80,000 and 6,000 years ago. And for that we will have to take seriously the need for submarine exploration.

Turning to the more recent record of prehistoric developments, many authors have implicated marine resources in the early development of agriculture. Carl Sauer (1952) first suggested that sedentary settlements in rich coastal environments might have favoured early experiments with plant domestication. Subsequently archaeologists have developed a number of variations on this theme, with particular emphasis on the social and demographic consequences of sedentary coastal settlement. Binford (1968), in an influential paper, argued that coastal sedentism would have encouraged population growth and emigration to adjacent hinterlands, where the consequent competition for scarce resources might have stimulated early moves to plant and animal domestication. Others have concentrated on the consequences of high population density and social stratification that can follow the establishment of sedentary settlements and food storage practices in highly productive coastal environments. In many of these cases the resulting high levels of economic production and population density seem to have acted as a barrier to the introduction of plant agriculture rather than an encouragement, although climatic disincentives to crop cultivation are also involved (Aikens et al. 1986; Baumhoff 1963; Rowley-Conwy 1983).

In at least two cases of early state development, marine resources have been assigned a pivotal role. In pre-Inca Peru, productive anchovy fisheries have been invoked as the economic foundation for social developments with monumental architecture and centralised political organisation (Moseley 1975; Moseley and Feldman 1988). In the Arabian Peninsula Tosi has argued that the productive coastal fringe was the source of a

reliable, year-round supply of marine foods that favoured economic specialisation and complementarity with a less productive interior, and a favourable corridor for long-distance exchange and the dispersal of plant crops between Africa and Asia (Tosi 1986). In both areas, counter-evidence and counter-arguments have been advanced calling into question the dependence on marine resources, and their contribution remains a matter of unresolved debate (Macchiarelli 1989; Osborn 1977; Raymond 1981; Wilson 1981).

Similar arguments have been proposed for the contribution of aquatic resources to early developments in the Nile Valley. Indeed all the earliest of the great Old World urban civilisations are based on major river systems, which have similar environmental attractions to coastlines, productive aquatic resources and intimate contacts with their adjacent coastal regions.

Conclusion

In contrast to the conventional picture of world prehistory described at the beginning of this paper, with its landlubber's emphasis on achievements on land, I have argued here that almost no part of the human record is untouched by the influence of coastlines, marine resources and ultimately seaborne contacts. Many coastlines around the world have evidence of coastal sites and shell mounds that offer rich and well preserved material for the reconstruction of social and economic life, and potential for the elaboration of mythical and symbolic histories constructed out of the contrasting worlds of land and sea. In the seas around India, the shell mounds of the Andaman Islands have long been famous (Cooper 1993; Dutta 1989), although comparable prehistoric shell middens have not been reported from the mainland. The key, however, to filling out this picture must lie in two research strategies. The first is a systematic investigation of the submerged parts of the continental shelf, and in particular a search for evidence of coastal settlements and the extent to which marine resources were incorporated into coastal palaeoeconomies before the Postglacial period of modern sea levels. The recent finds from the Gulf of Khambhat offer a tantalising glimpse of what may lie underwater, but this material need to be subjected to the same stringent tests that would be applied to archaeological material on land. The finds need to be properly published according to scientific standards rather than announced in newspapers and flashed on television screens and websites, and far more work needs to be done to establish their authenticity and date. The many finds already recorded from other parts of the world show that prehistoric sites can be preserved underwater in favourable conditions and can be analysed with the same range of techniques and questions that are applicable on land. The difficulties of such work should not be underestimated. A wide range of expertise in archaeology, geoarchaeology, geochronology, tectonic geomorphology, oceanography and palaeoenvironmental analysis will be needed to advance our understanding in such circumstances. Equally the opportunities for such work should not be underestimated either. It is time that this last frontier of archaeological discovery was properly addressed.

The second research strategy requires a more thorough examination of coastal archaeology associated with the modern coastlines of recent millennia, and a more focused approach to the long-term history of coastal settlements, marine resources and maritime activities. If the sites preserved underwater are growing in number, the voluminous coastal material available on land is under ever-growing threat of reduction by the destructive pressures of modern development. Certainly there is no shortage of questions and hypotheses to stimulate field observation.

Coastal margins have often been treated as just that – margins – peripheral alike to past human activities and the present attentions of archaeologists. Yet many of the smaller ocean basins have acted as unifying forces for the people that occupied the adjacent lands, stimulating contacts around their margins by land and sea, by direct seaborne routes between facing coastlines, and at times of lowered sea level across exposed shelves and land bridges. Increasingly the long archaeological records of human occupation in Northwest Europe are being viewed as aspects of the archaeology of the North Sea basin, rather than of the individual countries that border its margins. The same can be said of the Mediterranean, the Arabian Sea and the Bay of Bengal, to name only a few examples. In the modern era of global communications, the North Atlantic that separates Britain from North America is often referred to colloquially as 'the pond'. So must smaller ocean basins have seemed to many peoples of the past. It is time that coastlines ceased to be treated as margins and were brought more fully to the centre of archaeological attention.

References

- Aikens, C. M., Ames, K.M. and Sanger, D. 1986. Affluent collectors at the edges of Eurasia and North America: some comparisons and observations on the evolution of society among North-Temperate coastal hunter-gatherers. In T. Akazawa and C. Melvin Aikens (eds), *Prehistoric Hunter-Gatherers in Japan: New Research Methods*, pp. 3–26. The University Museum, the University of Tokyo, Bulletin 27.
- Baumhoff, M. A. 1963. Ecological determinants of Aboriginal California populations. *University of California Publications in American Archaeology and Ethnology* 49: 155–236.
- Binford, L.R. 1968. Post-pleistocene adaptations. In S.R. and L.R. Binford (eds), *New Perspectives in Archaeology*, pp. 313–41. Chicago: Aldine.
- Birdsell, J.B. 1953. Some environmental and cultural factors influencing the structuring of Australian Aboriginal populations. *American Naturalist* 87: 171–207.
- Bowdler, S. 1977. The coastal colonisation of Australia. In J. Allen, J. Golson and R. Jones (eds), *Sunda and Sahul*, pp. 205–46. London: Academic Press.
- Chappell, J. and Shackleton, N. J. 1986. Oxygen isotopes and sea level. *Nature* 324: 137–40.
- Clark, J.G.D. 1952. *Prehistoric Europe: The Economic Basis*. London: Methuen.
- Cohen, M.N. 1977. *The Food Crisis in Prehistory*. New Haven: Yale University Press.
- Coles, B.J. 1998. Doggerland: a speculative survey. *Proceedings of the Prehistoric Society* 64: 45–81.
- Cooper, Z. 1993. The origins of the Andaman Islanders: local myth and archaeological evidence. *Antiquity* 67: 394–99.
- Darwin, C. 1839. *Journal of Researches into the Natural History and Geology of the Countries Visited during the Voyage round the World of H.M.S. 'Beagle' under command of Captain Fitz Roy, R.N.* London: John Murray.

- Deacon, H.J. and Shuurman, R. 1992. The origins of modern people: the evidence from Klasies River. In G. Brauer and F.H. Smith (eds), *Continuity of Replacement: Controversies in Homo sapiens Evolution*, pp.121–29. Rotterdam: Balkema
- Dutta, P.C. 1989. Kitchen Middens (Shell Mounds). In A. Ghosh (ed.), *Encyclopaedia of Indian Archaeology*, Vol. 1, pp. 298–99. New Delhi: Munshiram Manoharlal Pvt Ltd.
- Erlandson, J.M. 2001. The archaeology of aquatic adaptations: paradigms for a new millennium. *Journal of Archaeological Research* 9: 287–350.
- Evans, J.G. 1969. The exploitation of molluscs. In P.J. Ucko and G.W. Dimbleby (eds), *The Domestication and Exploitation of Plants and Animals*, pp. 479–84. London: Duckworth.
- Fischer, A. 1995. *Man and Sea in the Mesolithic: Coastal Settlement Above and Below Present Sea Level*. Oxford: Oxbow.
- Flemming, N. 1998. Archaeological evidence for vertical movement on the continental shelf during the Palaeolithic, Neolithic and Bronze Age periods. In Stewart, I.S. and Vita-Finzi, C. (eds), *Coastal Tectonics*, pp. 129–46. London: Geological Society Special Publication 146.
- Galili, E., Weinstein-Evron, M. and Ronen, A. 1988. Holocene sea-level changes based on submerged archaeological sites off the northern Carmel coast in Israel. *Quaternary Research* 29: 36–42.
- Hancock, G. 2002. *Underworld: The Mysterious Origins of Civilisations*. London: Channel 4 Publications.
- Hardy, Sir Alister. 1960. Was man more aquatic in the past? *New Scientist* 7: 642–45.
- Henshilwood, C.S., Sealy, J.S., Yates, R., Cruz-Urbe, K., Goldberg, P., Grine, F.E., Klein, R.G., Poggenpoel, C.A., van Niekerk, K. and Watts, I. 2001. Blombos Cave, Southern Cape, South Africa: preliminary report on the 1992–1999 excavations of the Middle Stone Age levels. *Journal of Archaeological Science* 28: 421–48.
- Johnson L.L. and M. Stright (eds) 1992. *Paleoshorelines and Prehistory: An Investigation of Method*, pp. 151–69. Boca Raton: CRC Press.
- Kroeber, A.L. 1939. Cultural and natural areas of native North America. *University of California Publications in American Archaeology and Ethnology* 38.
- Lambeck, K. 1995. Late Devensian and Holocene shorelines of the British Isles and North Sea from models of glacio-hydro-isostatic rebound. *Journal of the Geological Society of London* 153: 437–48.
- Lister, S. and Teeman, T. 2002. Lost cities show civilisation began 9,500 years ago. *The Times*, January 19.
- Lourandos, H. 1997. *Continent of Hunter Gatherers: New Perspectives in Australian Prehistory*. Cambridge: Cambridge University Press.
- Lubbock, Sir J. 1865. *Prehistoric Times as illustrated by Ancient Remains and the Manners and Customs of Modern Savages*. London: Williams & Norgate.
- Luff, R. and Bailey, G.N. 2000. The aquatic basis of ancient civilizations: the case of *Synodontis schall* and the Nile Valley. In G.N. Bailey, R. Charles and N. Winder (eds), *Human Ecodynamics: Proceedings of the Association for Environmental*

- Archaeology Conference 1998* held at the University of Newcastle upon Tyne, pp. 100–13. Oxford: Oxbow.
- Macchiarelli, R. 1989. Prehistoric “fish-eaters” along the eastern Arabian coasts: dental variation, morphology, and oral health in the Ra’s al-Hamra community (Qurum, Sultanate of Oman, 5th–4th millennium bc). *American Journal of Physical Anthropology* 78: 575–94.
- Masters, P.M. and Flemming, N.C. (eds) 1983. *Quaternary Coastlines and Marine Archaeology*. London: Academic Press.
- Meehan, B. 1977. Hunters by the seashore. *Journal of Human Evolution* 6: 363–70.
- Morgan, L.H. 1877. *Ancient Society, or Researches in the Lines of Human Progress from Savagery through Barbarism to Civilization*. New York: Holt
- Morgan, E. 1982. *The Aquatic Ape*. London: Souvenir Press.
- Moseley, M.E. 1975. *The Maritime Foundations of Andean Civilization*. Menlo Park, California: Cummings.
- Moseley, M.E. and Feldman R.A. 1988. Fishing, farming and the foundations of Andean civilisation. In G. Bailey and J. Parkington (eds), *The Archaeology of Prehistoric Coastlines*, pp. 124–34. Cambridge: Cambridge University Press.
- Oppenheimer, S. 1998. *Eden in the East: The Drowned Continents of Southeast Asia*. London: Weidenfeld & Nicholson.
- Osborn, A.J. 1977. Strandloopers, mermaids, and other fairy tales: ecological determinants of marine resource utilization – the Peruvian case. In L.R. Binford (ed.), *For Theory Building in Archaeology*, pp. 157–205. New York: Academic Press.
- Palsson, G. 1988. Hunter-gatherers of the sea. In T. Ingold, D. Riches and J. Woodburn (eds), *Hunters and Gatherers: History, Evolution and Social Change*, Vol.1, pp. 189–204. Oxford, Berg.
- Perlman, S.M. 1980. An optimum diet model, coastal variability, and hunter-gatherer behavior. In M.B. Schiffer (ed.), *Advances in Archaeological Method and Theory*, pp. 257–310. New York: Academic Press.
- Raymond, J.S. 1981. The maritime foundations of Andean civilization: a reconsideration of the evidence. *American Antiquity* 46: 806–21.
- Renouf, M.A.P. 1988. Sedentary coastal hunter-fishers: an example from the Younger Stone Age of northern Norway. In G. Bailey and J. Parkington (eds), *The Archaeology of Prehistoric Coastlines*, pp. 102–115. Cambridge: Cambridge University Press.
- Rowley-Conwy, P. 1983. Sedentary hunters: the Ertebølle example. In G.N. Bailey (ed.), *Hunter-Gatherer Economy in Prehistory*, pp. 111–26. Cambridge: Cambridge University Press.
- Sauer, C.O. 1952. *Agricultural Origins and Dispersals*. New York: American Geographical Society.
- Sauer, C.O. 1962. Seashore – primitive home of man? *Proceedings of the American Philosophical Society* 106: 41–47.
- Stringer, C. 2000. Coasting out of Africa. *Nature* 405: 53–55.

- Stringer, C.B., Barton, R.N.E. and Finlayson, J.C. (eds) 2000. *Neanderthals on the Edge: Papers from a conference marking the 150th anniversary of the Forbes' quarry discovery, Gibraltar*. Oxford: Oxbow.
- Tosi, M. 1986. The emerging picture of prehistoric Arabia. *Annual Review of Anthropology* 15: 461–90.
- Van Andel, T. 1989. Late Quaternary sea-level changes and archaeology. *Antiquity* 63: 733–45.
- Walters, R.C., Buffler, R.T., Bruggemann, J.J., Guillaume, M.M.M., Berhe, S.M., Negassi, B., Libsekal, Y., Cheng, H., Edwards, R.L., von Gosel, R., Neraudeau, D. and Gagnon, M. 2000. Early human occupation of the Red Sea coast of Eritrea during the Last Interglacial, *Nature* 405: 65–69.
- Werz, B.E.J.S. and Flemming, N.C. 2001. Discovery in Table Bay of the oldest handaxes yet found underwater demonstrates preservation of hominid artefacts on the continental shelf. *South African Journal of Science* 97: 183–5.
- Wheeler, R.E.M. 1954. *Archaeology from the Earth*. Harmondsworth: Penguin.
- Wilson, D.J. 1981. Of maize and men: a critique of the maritime hypothesis of state origins on the coast of Peru. *American Anthropologist* 83: 93–120.
- Yesner, D.R. 1987. Life in the 'Garden of Eden': causes and consequences of the adoption of marine diets by human societies. In M. Harris and E.R. Ross (eds), *Food and Evolution*, pp. 285–310. Philadelphia: Temple University Press.
- Zarins, J., Al-Jawad Murad, A. and Al-Yish, K.S. 1981. The Comprehensive Archaeological Survey Program, a. The second preliminary report on the southwestern province. *Atlatl, the Journal of Saudi Arabian Archaeology* 5: 9–42.